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10/13/2004

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EXAMINER

MORRISON, JAY A

ART UNIT

PAPER NUMBER

2168

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

04/06/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/711,931

Applicant(s)

CHOWDHURI, SUDIPTO R.

Examiner

Jay A. Morrison

Art Unit

2168

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 January 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-70 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-70 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 October 2004 is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Remarks

1. Claims 1-70 are pending.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 48-70 are rejected under 35 U.S.C. 102(b) as being anticipated by Graefe ('Volcano – An Extensible and Parallel Query Evaluation System', IEEE Transactions on Knowledge and Data Engineering, Vol 6 No 1, February 1994).

As per claim 48,

A method for parallel optimization of a query requesting data from a database, the method comprising: (see abstract and background)

creating a plurality of operator trees for executing the query, the operator trees providing for execution of portions of the query in parallel; (query plans, page 124, first column, first paragraph)

adjusting the portions of the query to be executed in parallel based on memory resources available for executing the query; (generate parallel plan based on resources available, column 4, lines 43-55)

generating a schedule for execution of each operator tree; (ordering included in plan, page 128, second column, first paragraph)

returning a result indicating the operator tree having lowest execution cost based on its schedule for executing the query with available resources. (choose-plan, page 129, second column, second paragraph)

As per claim 49, Graefe teaches
the query comprises a Structured Query Language (SQL) expression. (page 122, first column, second paragraph)

As per claim 50, Graefe teaches
said creating step includes creating an operator tree including parallel operators for execution of portions of the query in parallel. (page 130, first column, second paragraph)

As per claim 51, Graefe teaches
said parallel operators comprise iterators for applying predefined behavior to data. (page 125, first column, second paragraph)

As per claim 52, Graefe teaches

said step of creating an operator tree includes creating operators for tasks to be performed in executing the query and said parallel operators provides for executing said tasks in parallel. (page 129, second column, fourth paragraph)

As per claim 53, Graefe teaches

a parallel operator executes in parallel across a plurality of storage units. (page 129, second column, fourth paragraph)

As per claim 54, Graefe teaches

a parallel operator executes in parallel across a plurality of CPUs. (page 129, second column, fourth paragraph)

As per claim 55, Graefe teaches

a parallel operator provides for pipelining of intermediate results from a first set of operators to a second set of operators. (page 128, first column, second paragraph)

As per claim 56, Graefe teaches

said creating step includes creating an operator tree using a partitioning property so as to partition data among operators. (page 130, first column, first paragraph)

As per claim 57, Graefe teaches

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said creating step includes generating a cost vector for each operator tree. (page 129, second column, second paragraph)

As per claim 58, Graefe teaches

said cost vector includes as components a selected one or more of work done by a processor in a given time, execution time of an operator, and resource usage of an operator for a certain time period. (page 129, second column, second paragraph)

As per claim 59, Graefe teaches

said creating step further comprises: pruning a first operator tree having a cost vector costing more in each vector dimension than a second operator tree. (page 129, second column, second paragraph)

As per claim 60, Graefe teaches

said creating step includes creating a plurality of operator trees based at least in part on partitioning and multi-dimensional costing. (page 130, first column fifth paragraph)

As per claim 61, Graefe teaches

said adjusting step includes adjusting an operator tree for available worker processes at compile time. (page 130, first column, fifth paragraph)

As per claim 62, Graefe teaches

said operator tree includes parallel operators for executing portions of the query in parallel and said adjusting step includes adjusting said parallel operators if necessary based on available memory resources. (page 129, second column, fourth paragraph)

As per claim 63, Graefe teaches

said adjusting step includes separating a resource intensive operator into a plurality of operators. (page 126, first column, second paragraph)

As per claim 64, Graefe teaches

said generating step includes identifying pipelines in each operator tree. (page 130, first column, sixth paragraph)

As per claim 65, Graefe teaches

said generating step includes constructing a pipeline dependency tree based on dependencies among operators of each operator tree. (page 130, first column, sixth paragraph)

As per claim 66, Graefe teaches

said creating step includes determining order of execution of pipelines based on the pipeline dependency tree and available resources. (page 130, second column, first paragraph)

As per claim 67, Graefe teaches

if resource usage of a particular pipeline is greater than resources available for the particular pipeline, splitting the particular pipeline into a plurality of pipelines. (page 130, second column, first paragraph)

As per claim 68, Graefe teaches

said step of splitting the particular pipeline includes adding operators for materializing the particular pipeline into a plurality of pipelines at intervals such that resource usage is evenly distributed over the plurality of pipelines. (page 130, second column, second paragraph)

As per claim 69, Graefe teaches

A computer-readable medium having processor-executable instructions for performing the method of claim 48. (abstract)

As per claim 70, Graefe teaches

A downloadable set of processor-executable instructions for performing the method of claim 48. (abstract)

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4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 1-47 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Graefe ('Volcano – An Extensible and Parallel Query Evaluation System', IEEE

Transactions on Knowledge and Data Engineering, Vol 6 No 1, February 1994) in view

of Graefe et al. ('Dynamic Query Evaluation Plans", Oregon Graduate Center, 1989,

ACM).

As per claim 1, Graefe teaches

In a database system, a method for parallel optimization of a query, the method comprising: (see abstract)

generating a plurality of parallel plans for obtaining data requested by the query, the parallel plans including parallel operators for executing portions of the query in parallel; (query plans, page 124, first column, first paragraph)

creating a schedule for each parallel plan indicating a sequence for execution of operators of each parallel plan; (ordering included in plan, page 128, second column, first paragraph)

adjusting parallel operators of each parallel plan if necessary based on resources available for executing the query (generate parallel plan based on resources available, column 4, lines 43-55).

and returning a result of a particular parallel plan having lowest execution cost for obtaining data requested by the query. (choose-plan, page 129, second column, second paragraph)

Graefe does not explicitly indicate “determining execution cost of each parallel plan based on its schedule and available resources”.

However, Graefe et al. discloses “determining execution cost of each parallel plan based on its schedule and available resources” (choose plan fetches information it needs to select best plan, page 363, first column, first paragraph; Table 1).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to combine Graefe and Graefe et al. because using the steps of “determining execution cost of each parallel plan based on its schedule and available resources” would have given those skilled in the art the tools to improve the invention by determining which plan is the most efficient. This gives the user the advantage of having better performance.

As per claim 2, Graefe teaches
the query comprises a Structured Query Language (SQL) expression. (page 122, first column, second paragraph)

As per claim 3, Graefe teaches
said generating step includes generating an operator tree for each parallel plan based on the query. (page 124, first column, third paragraph)

As per claim 4, Graefe teaches

said step of generating an operator tree includes generating nodes of the operator tree as iterators for applying predefined behavior to data. (page 124, first column, second paragraph)

As per claim 5, Graefe teaches

said step of generating an operator tree includes inserting a parallel operator in the operator tree. (page 130, first column, third paragraph)

As per claim 6, Graefe teaches

said step of generating an operator tree includes dividing a query operation into sub-tasks and said parallel operator provides for executing said sub-tasks in parallel. (page 126, first column, second paragraph)

As per claim 7, Graefe teaches

said parallel operator provides for executing said sub-tasks in parallel across a plurality of storage units. (page 130, first column, third paragraph)

As per claim 8, Graefe teaches

said parallel operator provides for executing said sub-tasks in parallel across a plurality of CPUs. (page 129, second column, fourth paragraph)

As per claim 9, Graefe teaches

said parallel operator provides for pipelining of intermediate results from a first set of operators to a second set of operators. (page 129, second column, fourth paragraph)

As per claim 10, Graefe teaches

said generating step includes generating a parallel plan using a partitioning property so as to partition data among operators of the parallel plan. (page 127, first column, first paragraph)

As per claim 11, Graefe teaches

said generating step includes generating a cost vector for each parallel plan.
(page 129, second column, second paragraph)

As per claim 12, Graefe teaches

said cost vector includes as components a selected one or more of work done by a processor in a given time, execution time of an operator in the parallel plan, and resource usage of an operator in the parallel plan for a certain time period. (page 129, second column, second paragraph)

As per claim 13, Graefe teaches

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said generating step further comprises: pruning a first parallel plan having a cost vector costing more in each vector dimension than a second parallel plan. (page 130, first column, second paragraph)

As per claim 14, Graefe teaches

said generating step includes generating a plurality of parallel plans based at least in part on partitioning and multi-dimensional costing. (page 130, first column, second paragraph)

As per claim 15, Graefe teaches

said adjusting step includes adjusting a parallel plan for available worker processes at compile time. (page 130, first column, third paragraph)

As per claim 16, Graefe teaches

the parallel plan comprises an operator tree and an adjustment is made to at least some parallel operators of the operator tree if the operator tree exceeds maximum configured worker processes. (page 129, second column, fourth paragraph)

As per claim 17, Graefe teaches

said step of adjusting parallel operators of each parallel plan if necessary based on resources available for executing the query includes adjusting parallel operators based on available memory resources. (page 129, second column, fourth paragraph)

As per claim 18, Graefe teaches

said creating step includes separating a resource intensive operator into a plurality of operators. (page 127, second column, second paragraph)

As per claim 19, Graefe teaches

said creating step includes identifying pipelines in each parallel plan. (page 130, first column, fifth paragraph)

As per claim 20, Graefe teaches

said creating step includes constructing a pipeline dependency tree based on dependencies among operators of each parallel plan. (page 130, first column, fifth paragraph)

As per claim 21, Graefe teaches

said creating step includes determining order of execution of pipelines based on the pipeline dependency tree and available resources. (page 130, second column, second paragraph)

As per claim 22, Graefe teaches

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if resource usage of a particular pipeline is greater than resources available for the particular pipeline, splitting the particular pipeline into a plurality of pipelines. (page 130, second column, second paragraph)

As per claim 23, Graefe teaches

said step of splitting the particular pipeline includes adding operators for materializing the particular pipeline into a plurality of pipelines at intervals such that resource usage is evenly distributed over the plurality of pipelines. (page 130, second column, second paragraph)

As per claim 24, Graefe teaches

A computer-readable medium having processor-executable instructions for performing the method of claim 1. (see abstract)

As per claim 25, Graefe teaches

A downloadable set of processor-executable instructions for performing the method of claim 1. (see abstract)

As per claims 26-40,

These claims are rejected on grounds corresponding to the arguments given above for rejected claims 1-15 and are similarly rejected.

As per claim 41, Graefe teaches

a parallel plan comprises an operator tree and the parallel scheduler adjusts at least some parallel operators of the operator tree based on available threads. (page 130, first column, fifth paragraph)

As per claims 42-47,

These claims are rejected on grounds corresponding to the arguments given above for rejected claims 18-23 and are similarly rejected.

Response to Arguments

6. Applicant's arguments with respect to claims 1-70 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

The prior art made of record, listed on form PTO-892, and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jay A. Morrison whose telephone number is (571) 272-7112. The examiner can normally be reached on M-F 8-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tim Vo can be reached on (571) 272-3642. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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